

LAKE MICHIGAN
2005 Creel Survey Report (*without Appendices*)

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2006

EXECUTIVE SUMMARY

- A modified-stratified-random creel survey of launched boat, shore and stream anglers was conducted on Lake Michigan from March 1 to December 31, 2005. The survey covered fishing by shore anglers and boat anglers (including chartered fishing trips) from several Indiana ports [Washington Park and Trail Creek Marina, Michigan City; numerous private ramps and slips on Burns Waterway; Pastrick Marina, East Chicago; Whihala Beach County Park boat launch, Whiting; and the Hammond Marina, (Hammond)] and stream anglers on three tributaries of Lake Michigan (Trail Creek, LaPorte County; East Branch of the Little Calumet River, Porter County and Salt Creek, Porter County).
- Due to Indiana's close proximity to neighboring states' borders (Illinois and Michigan), and the migratory nature of trout and salmon, many boat fishing trips were conducted in other states' waters. The estimates provided represent estimates of fish returned to Indiana ports. Because a subset of all fishing locations was surveyed, the creel survey cannot yield estimates of total harvest and effort for southern Lake Michigan. Rather, the creel data is used to monitor trends (provide sport fishing effort and harvest and catch estimates) in the Lake Michigan fishery.
- Estimated total fishing effort was 418,056 hours; a 37% increase in angler hours compared to 2004. Boat anglers accounted for 76% of the total angler hours.
- Estimated total catch from the combined fisheries was 510,738 fish representing 26 fish species; a 49% increase in catch compared to 2004. Catch included 333,993 yellow perch, 37,356 coho salmon, 20,026 Chinook salmon, 9,838 steelhead trout, 3,441 lake trout and 2,028 brown trout. The boat fishery, including chartered trips, dominated with a catch of 464,899 fish, or 91% of total.
- Boat anglers harvested primarily yellow perch, coho salmon, and Chinook salmon. Yellow perch dominated the shore harvest. Steelhead trout dominated the stream harvest.
- Coho salmon, Chinook salmon, steelhead, brown trout and lake trout harvest-rates all increased compared to the prior fishing season. However, comparing the 2005 salmonid harvest-rates with their long-term averages, only Chinook salmon and brown trout had rates that either equaled or exceeded their ten-year mean. The yellow perch harvest-rate decreased slightly from the prior fishing season, but was comparable to the ten-year average.
- A decline in the mean size of coho salmon, Chinook salmon, steelhead and brown trout was noted from lengths and weights collected from sport-caught salmonids.

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INTRODUCTION

Geographic area

Lake Michigan, with a surface area of 57,750 km², is the third largest of the Great Lakes and the sixth largest lake in the world (Beeton 1984). It is the only Great Lake entirely within the United States, but because of fish movement between Lakes Michigan and Huron and Michigan's discharge to Huron, the lake is important internationally (Eshenroder, et. al., 1995). Lake Michigan is divided into two basins; an irregularly shaped northern basin with a maximum depth of 922 feet, and a relatively smooth and contour southern basin with a maximum depth of 558 feet.

Indiana's portion of Lake Michigan is the smallest of the four states bordering the Lake (approximately 1% of the Lake Michigan area), encompassing approximately 43 miles of shoreline (224 square miles). Most of the area is highly developed and heavily industrialized, with the exception of the Dunes National Lakeshore and the Indiana Dunes State Park.

Several lakefront marinas provide boat and shore access. These include Washington Park and Trail Creek Marina, Michigan City; one municipal ramp and several private ramps along Burns Waterway, Portage; Robert A. Pastrick Marina, East Chicago; Lake County Parks and Recreation Whihala Beach boat launch, Whiting and Hammond Marina, Hammond. Three coal-fired power plants are also located along the shoreline, including the Northern Indiana Public Service Company (NIPSCO) Michigan City Generating Station, Michigan City; NIPSCO Bailly Generating Station, Burns Harbor and State Line Generating Station, Hammond. The NIPSCO Michigan City plant along with State Line Generating provide fishing opportunities for pedestrian anglers. No public entry is allowed at the NIPSCO Bailly Generating Station, although limited access exists just west of the station near Indiana Dunes National Lakeshore boat-in beach.

Various industries along the shoreline also provide access to pedestrian/shore and/or boat anglers (e.g., Bethlehem Steel, Burns Harbor; Midwest Steel, Burns Harbor; boat-in-beach between Burns Waterway and Port of Indiana, Portage; Amoco Whiting Refinery, Whiting; Hammond Water Filtration Plant; Hammond); however, access restrictions have become more common since the events of September 11, 2001.

Most of the Dunes National Lakeshore beaches are accessible to pedestrian anglers, with fishing allowed outside bathing-beach areas. Several county or city parks also exist for pedestrian and/or boat angler access.

Main tributaries of the Lake Michigan coastal area include: the Little Calumet River, Grand Calumet River, Turkey Creek, Deep River, Salt Creek, Coffee Creek, Dunes Creek, Trail Creek and the Galena River; and several smaller tributaries and man-made ditches. Watershed land uses range from urban, to industrial, to agricultural.

The southern Lake Michigan fishery

The slope of the near-shore lake bottom becomes progressively steeper from south to north, a geographic feature that influences the distribution and success of sport fishing. In general, most angler effort from Michigan City to Hammond has historically been directed at yellow perch (*Perca flavescens*) and salmonid species.

Smallmouth bass (*Micropterus dolomieu*), a near-shore species, play an important role in the Lake Michigan boat and shore fisheries. The addition of large rocks, glacial boulders and rip-rap to the lake during break wall construction has resulted in excellent smallmouth bass habitat. Smallmouth bass numbers have responded positively to the increase in habitat. As the availability and abundance of smallmouth have increased in southern Lake Michigan, so has the interest by anglers targeting smallmouth bass.

During the months of January, February, and March, fishing activity is limited to the streams and warm-water discharges along the shoreline. Indiana's boat fishing season typically begins during the months of March and April, with the majority of fishing activity occurring within a two-mile band along the shoreline. Due to annual migration patterns, most of the coho salmon (*Oncorhynchus kisutch*) stocked in the Lake by Illinois, Michigan, Wisconsin and Indiana will stage in southern Lake Michigan. Thus, coho salmon contribute close to 90% of the salmonid catch during the spring.

As the near-shore water temperatures begin to increase in late spring, the coho and other trout and salmon species move into deeper, colder, offshore waters. Between May and the end of July, boat anglers in pursuit of salmonids fish the deeper depths of Lake Michigan,

concentrating in Illinois and Michigan waters.

Yellow perch move closer to shore during this period to take advantage of warm surface waters.

From June through October, shore and boat salmonid effort increases with the return of steelhead trout (*Oncorhynchus mykiss*), coho salmon and Chinook salmon (*Oncorhynchus tshawytscha*) during their annual spawning migrations. These species return to the tributary or lake site where they were stocked as fingerlings. Chinook and coho salmon die after completion of spawning, whereas steelhead trout are multiple-year spawners. Two strains of steelhead, Skamania and Michigan, are stocked in Indiana's waters. The adult Skamania strain (summer-run) steelhead enter streams during the summer months and stay until they are ready to spawn in the spring. The Michigan steelhead (winter run) enter the tributaries through two separate migratory runs and will spawn in the late winter to early spring. The first run enters in late October and November and, like the Skamania, holds in the stream throughout the winter to await spawning time. The second run, which usually comprises the majority of the Michigan steelhead, enters the streams during March and April. These fish move upstream and immediately begin spawning activities.

At the close of the boating season during October and/or November, angler effort is again concentrated in the tributaries and warm-water discharges along the Indiana shoreline.

Stocking history

Salmon and trout have been an important component of the Lake Michigan fish community since the late 1960's. Lake trout (*Salvelinus namaycush*) stocking began in 1965 and coho salmon and Chinook salmon were introduced from the Pacific Northwest in 1966 and 1967 (Eshenroder et al., 1995). Rainbow trout, or steelhead and brown trout (*Salmo trutta*) were also extensively stocked. Of the five major salmonids stocked, only lake trout is released with the objective of rehabilitation (i.e., to re-establish reproducing populations). The others are stocked to provide angling opportunities and to utilize the overabundance of alewives (*Alosa pseudoharengus*), which entered the Lake Michigan system in 1949 from the Atlantic Ocean via the Welland Canal (The Welland Canal joined Lakes Erie and Ontario to bypass Niagara Falls,

a natural barrier for aquatic organisms). An annual average of 13.8 million fingerling trout and salmon have been stocked into Lake Michigan since 1993 (Hanson 2006).

The Indiana Department of Natural Resources (IDNR), Division of Fish and Wildlife has stocked trout and salmon along the southern shoreline of Lake Michigan since 1969. The area stocked extends from Michigan City to Whiting and includes sites along the St. Joseph River, Trail Creek and the East Branch of the Little Calumet. The number of trout and salmon stocked in Indiana waters of Lake Michigan from 1993 to 2005 has averaged 1.2 million fish per year (Table 1).

The objective of the angler creel survey is to assess sport fish harvest, fishing pressure and angler opinions. The choice of survey design, time frame for the survey, locations/days surveyed (e.g. sample size determination) and selection of the sample were influenced by the creel survey objective and funding availability. Due to limitations in site access (i.e. private industrial areas and restrictions due to heightened national security) and budget, the survey can only provide an index of fishing harvest and effort along Lake Michigan and its tributaries. The majority of popular fishing sites, including marina's, public piers, and public land (e.g. state and county-managed public lands), were included in the survey design. The sampling time frames represent the period when the majority of the population fishing Lake Michigan can be reached. These data assist the Division of Fish and Wildlife's Lake Michigan fishery management efforts in providing valuable trend information concerning the status of sport fish in Lake Michigan and provides the sport community with catch-effort statistics.

A creel program also exists for the St. Joseph River, however, the catch, harvest and effort estimates presented in this report are exclusive of the St. Joseph River project.

METHODS

The on-site, intercept survey design was divided into boat, shore and stream components. The boat and shore fishery survey was conducted from April through October, 2005, as part of the Division of Fish and Wildlife Work Plan 200750 that covers sport fish monitoring in Lake Michigan. The stream survey was conducted in March and July through December, 2005, as part of the same work plan.

Boat and shore anglers were surveyed using a modified, two-stage stratified random access sampling design. Four main areas/sites were monitored, including: Washington Park and Trail Creek Marina in Michigan City; numerous private ramps and slips on Burns Waterway (i.e. Lefty's Coho Landing, Portage Marina, Doyne's Marina, Treasure-Chest Marina, etc.) in Portage; Pastrick Marina in East Chicago; and the Lake County Parks and Recreation Whihala Beach boat launch in Whiting along with Hammond Marina in Hammond. The shore fishery was monitored at the Michigan City Washington Park pier, Port of Indiana public access site (Portage), East Chicago Pastrick Marina pier and the Hammond Marina pier.

Stream anglers were surveyed using a modified, two-stage stratified random roving sampling design. Due to the area encompassed by the Lake Michigan watershed, the survey area was divided into three sites including Trail Creek, East Branch of the Little Calumet River and Salt Creek. Trail creek was sampled from the Trail Creek basin upstream to Johnson Road, the East Branch of the Little Calumet River was sampled from the Ameriplex complex (S.R. 249) upstream to the Indiana National Lakeshore Heron Rookery (600 East) and Salt Creek was sampled from the Ameriplex complex (S.R. 249) upstream to U.S. 30.

Three types of data were collected for each site: angler and boat/vehicle counts for effort, angler interviews for harvest rates, and biological information on harvested fish. Launched boat and moored boat anglers were interviewed at the completion of their fishing trips while shore and stream anglers were contacted while they were fishing (i.e. complete and incomplete fishing trips collected). Anglers or angler parties (each interview consists of one angling party or the total number of anglers fishing per vehicle or boat) were asked what time they started their fishing trip, what they fished for, and the number of fish caught and harvested. Additional information about angler county of residence, species preference and angler satisfaction was also collected. Biological sampling of harvested fish included length (total length, mm), weight (kg), fin clip and tag collection.

A more detailed description of the lake and stream creel methodology (i.e. spatiotemporal frames, on-site procedures, harvest/catch and effort calculations) can be found in Palla 2003.

RESULTS

Due to Indiana's close proximity to neighboring states' borders (Illinois and Michigan), and the migratory nature of trout and salmon, many boat trips were actually conducted in other states' waters. The estimates provided in this report represent estimates of fish returned to Indiana ports. Only a subset of all fishing locations (four ports and three tributaries) are included in the creel survey. Harvest and effort are not expanded to non-surveyed areas. Thus, the survey is not designed to yield estimates of total harvest and effort for southern Lake Michigan but rather to monitor trends (i.e. provide sportfishing effort and harvest estimates). Catch and effort estimates are presented without confidence intervals.

From March 1 to December 31, 2005, 3,817 angler interviews (representing 8,104 anglers) were collected from pedestrian (shore and stream) and boat anglers. Anglers fished an estimated 418,056 hours, an increase over the 2004 fishing season when anglers spent 304,518 hours fishing Lake Michigan and tributaries (Table 2). Seventy-six percent of the fishing pressure came from boat anglers (Table 2). Stream anglers followed with 67,257 hours or 16% of the total.

Highest boat fishing effort occurred in June (82,333 hours), followed by April (65,289 hours), July (63,381 hours) and September (48,006 hours, Table 3). June (8,974 hours) and July (8,184 hours) were the months of greatest shore fishing activity (Table 4). Stream anglers primarily fished the months of October (22,108 hours), September (12,663 hours) and March (10,494 hours, Table 5).

Total catch from the combined fisheries was 510,738 fish representing twenty-six fish species (Palla 2006). This was a 49% increase in catch from 2004. Yellow perch accounted for the bulk of the catch by number (Table 6). For salmonid species, the total catch was dominated by coho salmon, comprising 51% of the total. Chinook salmon harvest was second to coho, with 27% of the total, followed by steelhead (13%), lake trout (5%) and brown trout (3%, Table 6).

Boat anglers also dominated the number of fish harvested and released, 464,899 fish or 91% of the total (Table 2).

Trout and salmon (directed effort and harvest)

Anglers spent 274,161 hours pursuing trout and salmon, harvesting 68,234 fish, all fisheries combined. This harvest was 73% higher than the 2004 salmonid harvest, but 22% below the ten-year average of 87,443 fish (Table 7). Effort increased 39% from 2004 (Table 7). The harvest of Chinook salmon, coho salmon, steelhead, lake trout and brown trout increased between 2 and 10-fold compared to the 2004 harvest (Table 7).

Comparing lake survey sites, Michigan City was the port with the highest boat and shore salmonid effort (93,009 hours) and salmonid harvest (29,029, Table 8). Within the tributaries, Trail Creek accounted for the greatest angler effort and harvest from the three Lake Michigan tributaries surveyed (Table 8).

The combined harvest rate for salmonids (boat, shore and stream fisheries) was 24.9 fish per 100 angler-hours, slightly lower than the ten-year average of 26.7 fish/100 angler-hours (Figure 1). As with harvest, all species experienced an increase in their harvest rate compared to the 2004 fishing season (Figures 2 through 6). Comparing 2005 salmonid harvest rates with their long-term averages, only Chinook salmon and brown trout had rates that either equaled or exceeded their ten-year mean (Figures 3 and 5).

Biological data collected on coho salmon, Chinook salmon and steelhead showed a slight downward trend in mean size. The average length of coho salmon harvested was 20.1 (± 2.4) inches, slightly lower than the 2004 average of 20.7 (± 3.1) but within the ten year average (Palla 2006). Average weight of harvested coho was 2.7 (± 1.2) pounds. This average was lower than the six year mean of 3.1 (± 1.7) pounds (Palla 2006).

Mean total length of harvested Chinook salmon was 27.7 (± 4.8) inches; mean weight was 7.9 (± 3.6) pounds. Both the mean length and weight were lower than what was observed in 2004. The average Chinook weight remains below the six year average of 10.3 (± 4.8) pounds (Palla 2006). Yearly Chinook mean weight has remained below its long-term average for the prior three creel seasons.

The average total length of harvested steelhead, 26.7 (± 3.7) inches, was slightly lower than the observed ten year average of 27.5 (± 4.1) inches (Palla 2006). Mean weight, however, decreased by 17% compared to 2004 at 6.7 (± 2.7) pounds. This was also 13% below the mean

weight observed over the last six fishing seasons (Palla 2006).

The average brown trout length of 22.8 (\pm 4.6) inches and weight of 6.0 (\pm 4.2) pounds was similar to what was observed during 2004. Average total length and weight remain slightly higher than the long-term mean (Palla 2006).

For lake trout, the mean length and weight of harvested fish has remained relatively stable since 1999 (Palla 2006).

Yellow perch (directed effort and harvest)

Boat and shore anglers harvested 178,945 yellow perch, a 24% increase in harvest compared to 2004 (Table 9). The number of hours anglers pursued perch increased 32% from 97,971 (2004) to 129,630 (2005) hours (Table 9).

Boat anglers accounted for the majority of the yellow perch harvest, 171,823 fish or 96% of the total. June through September were the primary months perch were caught from the lake proper for both boat and shore anglers (Tables 3, 4).

Highest perch harvest was reported from Michigan City, followed by East Chicago and Burns Waterway (Table 8). Highest yellow perch angler-effort was recorded at East Chicago.

The yellow perch harvest-rate (standardized to fish per angler-hour) was 1.38 fish/hour, a decrease from the prior fishing season but similar to the ten-year average of 1.35 perch/hour (Figure 7). The 2005 directed perch harvest was one of the highest recorded harvests since levels observed during the 1990's. The yellow perch catch, or the number of fish that were harvested and released, increased 65% from the 2004 catch of 201,906 fish (Table 9).

Harvested yellow perch ranged from 4.6 to 15.8 inches in length. Mean total length, 10.4 (\pm 1.8) inches, and mean weight, 0.5 (\pm 0.3) pounds, were higher than what was observed in 2004 and similar to the long-term mean (Palla 2006).

Black bass species

A total of 9,199 black bass (mainly smallmouth) were caught from the boat and shore fisheries during 2005 (Table 10). The 2005 catch was 77% higher than the 2004 catch of 5,205 fish. Effort directed at bass in Lake Michigan also increased, 46% higher than the effort

observed in 2004 (Table 10). The majority of fishing occurred from boats, accounting for 85% of the catch and 67% of the effort.

Bass anglers release the majority of fish they catch. Of the fish caught by shore and boat anglers, 98% of those were released. Boat anglers released 99% (7,698) of their catch while shore anglers released 92% (1,287). In the boat fishery, the number of legal-sized bass released outnumbered the sub-legal (less than 14.0 inches) releases. In the shore fishery, the opposite was true, with the number of sub-legal sized bass released outnumbering legal releases.

Species preference

A total of 3,785 anglers responded to the question of which species of fish they preferred to catch from Lake Michigan. Forty-nine percent of boat anglers included at least one salmonid species in their response. On a species by species basis, boat anglers ranked yellow perch as their most preferred fish (43%), followed by Chinook salmon (20%), steelhead (12%), coho salmon (10%) and bass (6%). Forty-four percent of shore anglers included at least one salmonid in their reply. By species, shore anglers also ranked yellow perch as their most preferred fish (37%), followed by steelhead (22%), smallmouth bass (8%), Chinook salmon (7%), coho salmon (7%), no preference (7%) and brown trout (2%). Stream anglers ranked steelhead as their most preferred fish (74%), followed by Chinook salmon (8%), any trout or salmon species (5%), coho salmon (5%), brown trout (3%) and no preference (3%).

Angler residency

Anglers fishing Lake Michigan came from 61 Indiana counties as well as from out-of-state during the creel period (Palla 2006). Lake County accounted for 31% of the total anglers followed by out-of-state anglers (20%), Laporte County (18%) and Porter County (15%). Other counties with frequent use included St. Joseph, Marion, Elkhart, Allen, Tippecanoe, Kosciusko, Jasper, Marshall and Starke Counties.

Illinois residents represented 87% of the out-of-state fishing parties, primarily Cook and Will Counties.

Angler responses to importance and satisfaction questions

At the end of the interview, fishing parties were asked to rate the importance they placed on having the species they were targeting (on that day's trip) in Lake Michigan and their overall satisfaction with the quality of that fishery within the past 2-year period. If the fishing party was targeting any trout or salmon, all five trout and salmon species were asked to be rated (stream parties were not asked to rate lake trout since lake trout typically do not reside within the stream watershed). Parties were instructed the questions were to be rated on a scale of 1 to 5, with 1 being the lowest (poor) and 5 being the highest (excellent). If the party was unable to rate these questions because of lack of fishing experience, the rating was recorded as a six ("6"). All three fisheries responses were combined and summarized. Responses were also separated by fishery and summarized (Palla 2006).

The majority of the fishing parties pursuing trout and salmon rated species importance as important to very important. Yellow perch anglers were similar; 95% of the parties gave perch importance the higher ratings (Palla 2006).

Overall, the trout and salmon fishing parties were somewhat satisfied to extremely satisfied with the quality of the salmonid fishery. Both brown trout and lake trout anglers rated importance as high; however, satisfaction for these two species was more wide spread. Boat, shore and stream anglers were less satisfied with the quality of these fisheries compared to other salmonid species. Only 5% of the yellow perch parties (boat and shore) were not satisfied (less satisfied and not satisfied) with the perch fishery (Palla 2006).

DISCUSSION

The success of a fishing season in Indiana waters of Lake Michigan is heavily influenced by several factors including, but not limited to, weather patterns, near shore water temperatures, stocking levels, forage levels, fish movement and angler effort. Positive and/or negative changes to these factors can significantly alter the outcome of a particular fishing year.

The harvest/catch increases observed for all trout and salmon, yellow perch and black bass species are a direct result of increased effort by anglers, particularly boat anglers. The 2005 boat angler-effort increased 51% over 2004 (317,945 hours versus 210,239 hours), and the

number of salmonids, yellow perch and bass boat anglers caught increased 81% (63,846 salmonids versus 35,303), 66% (318,277 perch versus 191,744), and 92% (7,804 bass versus 4,064) respectively.

Based solely upon the harvest numbers presented in Table 8, the 2005 salmonid season could be categorized as good. However, the better measure of a seasons' success is by evaluating the harvest rate, or looking at the long-term trend of fishing success. Coho, Chinook, steelhead, brown trout and lake trout harvest-rates all increased compared to the prior fishing season. However, comparing the 2005 salmonid harvest-rates with their long-term averages, only Chinook salmon and brown trout had rates that either equaled or exceeded their ten-year mean. The fishing success for coho, steelhead and lake trout remained below-average.

The yellow perch harvest-rate decreased slightly from the prior fishing season, but was comparable to the ten-year average. Angling opportunities for yellow perch remain steady; with anglers finding better action since initial harvest restrictions were initiated in 1997.

The perch fishery now is mainly supported by the 1998 year class. This year class has had a positive effect on the sport fishery, providing larger and greater sport harvests. This is evident when looking at the recreational catch and average length/weight of fish harvested. This year class, comprised mainly of females, have been responsible for producing larger year classes than observed prior to 1998 (Brian Breidert, personal communication). While reproductive potential and spawner stock biomass is increasing, we should remain cautiously optimistic. Factors still exist that limit survival of yellow perch in the first year of life, including but not limited to: exotic species; food density, size structure and composition; predation and temperature. These same factors also impact the direct survival of other sport fish species such as salmonids. The number of salmon the lake can sustain changes over time.

Over the past several seasons, there has been exceptional Chinook salmon fishing on Lake Michigan. Approximately 8.5 million pounds were harvested by sport anglers in 2004 (Breidert et. al. 2005). Chinook harvest-rates from the Indiana Lake Michigan creel survey confirm this exceptional success. This great fishing suggests there is a larger number of Chinook salmon in the lake than stocking can explain and/or Chinook are more willing (aggressive) to bite. The latter suggests negative changes in the forage base (i.e. Chinook are hungry and are

taking anything in sight). In fact, increased numbers of Chinook from natural reproduction and a declining trend in the number and condition (weight at a given length) of alewife have been identified. Ball State University trawl catch-per-unit-effort for alewife has trended downward for the second straight year in 2005 (Allen 2005). This not only has ramifications for Chinook, the largest consumer of alewife, but other salmonid species as well. In 2005, a decline in the mean size (i.e. average length and weight) of coho salmon, Chinook salmon, steelhead and brown trout was noted from the creel survey. A continued decline in abundance in the alewife population can have negative consequences for trout and salmon, but could provide perch an opportunity to produce large year classes (Shroyer and McComish 2000).

The number of fish Lake Michigan can support will continue to change over time as new species introductions and habitat alterations impact the system. It is important to realize that changes, positive and/or negative, will impact future fishing success. One example of change can be observed through the Lake Michigan smallmouth bass fishery. Smallmouth numbers appear to have responded positively to habitat alterations and unintentional species additions (i.e. round goby). In turn, increased interest and success by anglers targeting smallmouth bass has been observed. Thus, information on sport fishery harvest, catch per unit effort, and biological information is essential to make sound management decisions and develop a better understanding of population dynamics. The Lake Michigan creel survey and design should continue to be refined in order to provide the most accurate and precise survey estimates from the fishery.

RECOMMENDATIONS

- The Lake Michigan office continue compiling creel methodology prior to 1993 to understand sampling design and methods utilized for data expansion and computation of projected totals.
- Implementation of the recommended changes to the creel sampling design, including but not limited to: scheduling and coverage of the sample day and reliability of effort and harvest estimates. All changes to the creel sampling design will be documented and made available with the creel summary data.

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Date: March 09, 2006

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Date: March 23, 2006

Table 1. Number of trout and salmon stocked in Lake Michigan by Indiana Department of Natural Resources (IDNR), 1993 through 2005.

Year	LAKE MICHIGAN					ST. JOSEPH RIVER			
	Chinook Salmon	Coho Salmon	Steelhead	Brown Trout	Total	Chinook Salmon	Coho Salmon	Steelhead	Total
'93	292,464	12,316	295,837	0	600,617	166,142	0	180,512	346,654
'94	368,026	84,397	378,522	0	830,945	168,938	0	172,975	341,913
'95	364,182	165,809	301,052	0	831,043	190,819	0	188,842	379,661
'96	362,162	266,549	312,776	0	941,487	209,407	75,980	254,135	539,522
'97	279,297	80,817	340,010	0	700,124	143,262	0	287,174	430,436
'98	386,525	148,320	183,715	0	718,560	206,987	0	299,869	506,856
'99	264,608	146,882	319,082	0	730,572	150,811	0	252,491	403,302
'00	267,865	157,208	174,136	0	599,209	149,911	0	220,439	370,350
'01	297,195	157,048	297,971	0	752,214	153,520	0	293,475	446,995
'02	253,000	224,797	298,884	35,000	811,681	0	0	306,297	306,297
'03	232,395	233,248	309,134	40,400	815,177	0	0	282,857	282,857
'04	237,052	236,026	334,968	46,238	854,284	0	0	278,109	278,109
'05	251,281	237,009	645,576	36,371	1,170,237	0	0	287,471	287,471

Table 2. Estimated angler hours and catch from Lake Michigan during 2005, based on total effort.

Fishery	Total Effort	%	Catch	%
Boat	317,945	(76%)	464,899	(91%)
Shore	32,854	(8%)	38,324	(7%)
Stream	67,257	(16%)	7,515	(2%)
TOTAL	418,056	100	510,738	100

Table 3. Boat fishery monthly estimated catch and effort from the IDNR Lake Michigan creel survey during 2005, based on total effort.

Species	April	May	June	July	Aug.	Sept.	Oct.	Total
Steelhead	1,422	327	2,780	412	138	410	9	5,498
Coho	23,988	5,072	2,986	1,346	321	767	20	34,500
Chinook	606	2,183	3,196	6,542	2,413	3,739	214	18,893
Lake trout	164	569	827	213	331	1,161	176	3,441
Brown trout	876	183	97	209	57	92	0	1,514
TOTAL	27,056	8,334	9,886	8,722	3,260	6,169	419	63,846
Yellow perch	1,989	3,010	126,327	94,029	57,670	32,484	2,868	318,377
Black Bass sp.	809	1,166	1,796	1,408	278	2,011	336	7,804
Other	539	4,156	54,647	11,891	936	1,618	1,085	74,872
Angler hours	65,289	27,780	82,333	63,381	22,947	48,006	8,209	317,945

Table 4. Shore fishery monthly estimated catch and effort from the IDNR Lake Michigan creel survey during 2005, based on total effort.

Species	April	May	June	July	Aug.	Sept.	Oct.	Total
Steelhead	72	29	240	368	0	24	6	739
Coho	161	14	0	0	0	114	0	289
Chinook	0	0	0	0	0	117	50	167
Lake trout	0	0	0	0	0	0	0	0
Brown trout	106	14	8	5	0	0	0	133
TOTAL	339	57	248	373	0	255	56	1,328
Yellow perch	0	151	7,319	2,287	5,379	463	17	15,616
Black Bass sp.	82	253	187	446	274	99	54	1,395
Other	1,385	2,312	7,757	4,401	2,588	1,142	400	19,985
Angler hours	4,016	2,556	8,974	8,184	4,125	3,771	1,228	32,854

Table 5. Stream fishery monthly estimated catch and effort for trout and salmon during 2005.

Species	March	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Steelhead	732	857	485	573	422	201	331	3,601
Coho	1,002	0	0	492	912	98	63	2,567
Chinook	0	0	0	208	650	108	0	966
Lake trout	0	0	0	0	0	0	0	0
Brown trout	285	10	0	13	65	0	8	381
TOTAL	2,019	867	485	1,286	2,049	407	402	7,515
Angler hours	10,494	9,931	5,199	12,663	22,108	4,285	2,577	67,257

Table 6. Estimated salmonid and yellow perch catch from the IDNR Lake Michigan creel survey during 2005, based on total effort.

Yellow perch	333,993	
Salmonids	<u>72,689</u>	
	406,682	
Coho	37,356	(51.4%)
Chinook	20,026	(27.5%)
Steelhead	9,838	(13.5%)
Lake Trout	3,441	(4.7%)
Brown Trout	2,028	(2.8%)

Table 7. Estimated trout and salmon harvest from the IDNR Lake Michigan creel survey during 1996 through 2005, based on directed effort.

Year	Chinook	Coho	Steelhead	Lake Trout	Brown Trout	Total	Directed Effort (hrs.)
1996	5,752	27,836	10,946	10,566	1,006	56,106	299,818
1997	5,976	76,470	11,946	11,123	3,340	108,855	355,289
1998	4,952	69,258	22,290	22,795	963	120,258	379,743
1999	8,691	45,465	16,496	2,888	754	74,294	354,481
2000	11,006	76,227	14,968	3,230	2,787	108,218	353,750
2001	7,864	72,171	9,605	3,910	2,244	95,794	334,359
2002	14,483	100,351	13,178	1,221	2,378	131,611	362,228
2003	7,092	53,935	9,223	374	942	71,566	290,486
2004	10,966	23,079	4,199	281	974	39,499	197,291
2005	19,098	35,858	8,421	3,208	1,649	68,234	274,161
avg.	9,588	58,065	12,127	5,960	1,704	87,443	320,161

Table 8. Estimated harvest of trout and salmon and yellow perch, by site, from the IDNR Lake Michigan creel survey during 2005, based on directed effort.

	Chinook	Coho	Steel-head	Lake Trout	Brown Trout	Yellow Perch	Directed Effort	
LAKE							Salmonid	Perch
Michigan City	7,662	15,823	3,289	1,853	402	69,903	93,009	36,346
Burns Waterway	2,068	3,864	981	328	210	37,996	35,990	31,170
East Chicago	7,503	13,564	1,563	890	664	48,567	70,638	42,988
Hammond	1,075	535	62	137	99	22,479	7,267	19,126
STREAM								
Trail Creek	390	1,484	1,960	0	274	---	48,590	---
E. Branch Little Cal.	111	154	264	0	0	---	10,322	---
Salt Creek	289	434	302	0	0	---	8,345	---
NO. RELEASED	Chinook	Coho	Steel-head	Lake Trout	Brown Trout	Yellow Perch	Total Released	
Trail Creek	37	313	685	0	77	---	1,112	
E. Branch Little Cal.	75	102	188	0	18	---	383	
Salt Creek	64	80	202	0	12	---	358	

Table 9. Estimated yellow perch harvest, catch, and effort from the IDNR Lake Michigan creel survey, 1986 through 2005, based on directed effort.

Year	Effort (hrs.)	Harvest	Total harvest/hr.	Catch¹	Total catch/hr.
1986	---	235,944	---	---	---
1987	---	192,365	---	---	---
1988	75,030	240,251	3.20	---	---
1989	65,610	158,931	2.42	---	---
1990	74,492	132,249	1.78	---	---
1991	133,912	273,888	2.05	---	---
1992	102,600	171,561	1.67	---	---
1993	88,674	146,560	1.65	---	---
1994	44,124	66,785	1.51	71,920	1.63
1995	55,900	69,770	1.25	80,312	1.44
1996	76,360	137,791	1.80	159,168	2.08
1997	33,938	32,390	0.95	34,532	1.02
1998	40,125	37,532	0.94	50,494	1.26
1999	90,622	132,217	1.46	227,304	2.51
2000	96,537	129,988	1.35	215,382	2.23
2001	122,770	140,089	1.14	216,341	1.76
2002	97,161	124,656	1.28	198,275	2.04
2003	119,200	207,401	1.74	309,561	2.60
2004	97,971	144,442	1.47	201,906	2.06
2005	129,630	178,945	1.38	332,320	2.56

¹Catch data estimates not available for 1986-1993.

Table 10. Estimated number of black bass harvested and released by boat and shore fisheries from the IDNR Lake Michigan creel survey during 2000 through 2005, based on total harvest and directed effort.

		No. Harvested	No. Released	Directed Effort (hrs.)
<u>2000</u>	Boat	230	sub-legal = 2,086 legal = 5,007	11,456
	Pier	84	sub-legal = 1,051 legal = 705	3,212
	Total	314	8,849	14,668
<u>2001</u>	Boat	322	sub-legal = 1,988 legal = 4,447	10,475
	Pier	70	sub-legal = 862 legal = 275	2,208
	Total	392	7,572	12,683
<u>2002</u>	Boat	111	sub-legal = 9,022 legal = 7,606	18,257
	Pier	132	sub-legal = 438 legal = 207	2,101
	Total	243	17,273	20,358
<u>2003</u>	Boat	367	sub-legal = 1,253 legal = 4,220	13,794
	Pier	78	sub-legal = 902 legal = 135	1,850
	Total	445	6,510	15,644
<u>2004</u>	Boat	194	sub-legal = 1,789 legal = 2,081	6,020
	Pier	89	sub-legal = 901 legal = 151	1,247
	Total	283	4,922	7,267
<u>2005</u>	Boat	106	sub-legal = 3,410 legal = 4,288	8,470
	Pier	108	sub-legal = 1,033 legal = 254	2,134
	Total	214	8,985	10,604

Mean harvest rate = 26.7 fish/100 hrs.
Range: 18.7 - 36.3

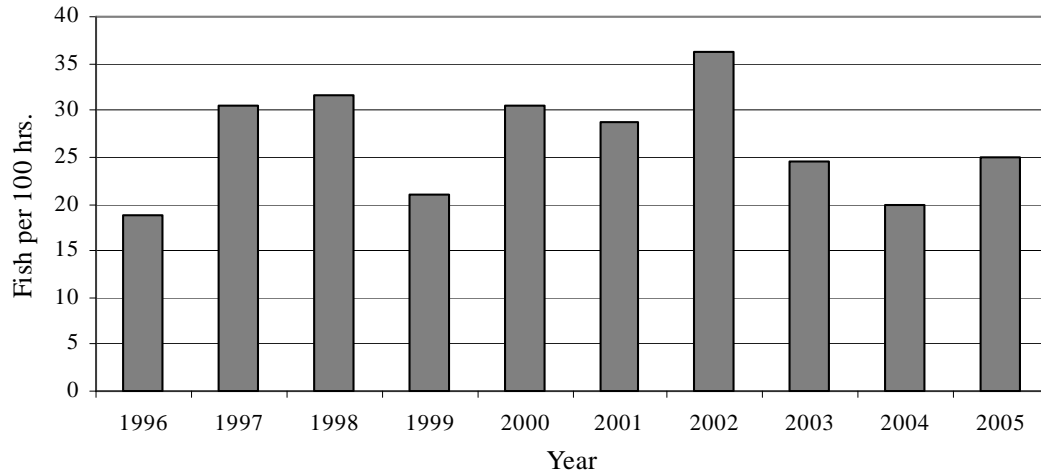


Figure 1. Trout and salmon harvest rate from the IDNR Lake Michigan creel survey during 1996 through 2005, based on directed effort.

Mean harvest rate = 17.6 fish/100 hrs.
Range: 9.3 - 27.7

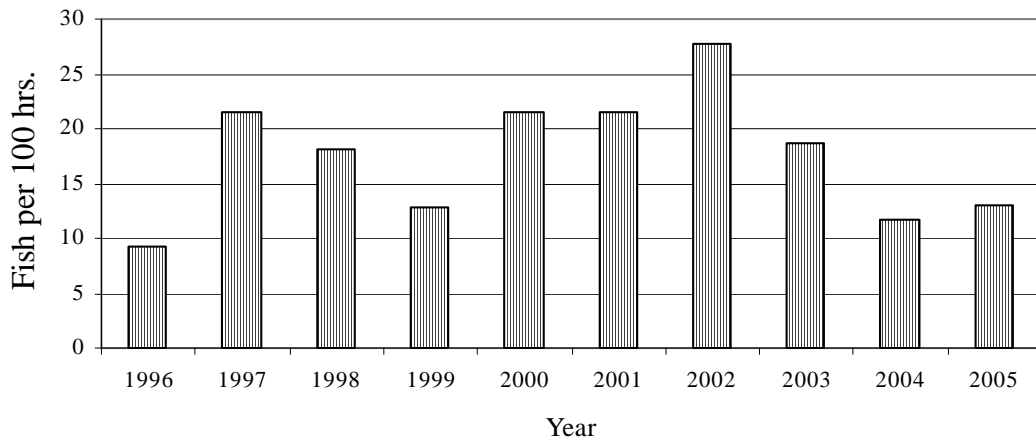


Figure 2. Harvest rate for coho salmon from the IDNR Lake Michigan creel survey during 1996 through 2005, based on directed effort.

Mean harvest rate = 3.2 fish/100 hrs.
Range: 1.1 - 7.0

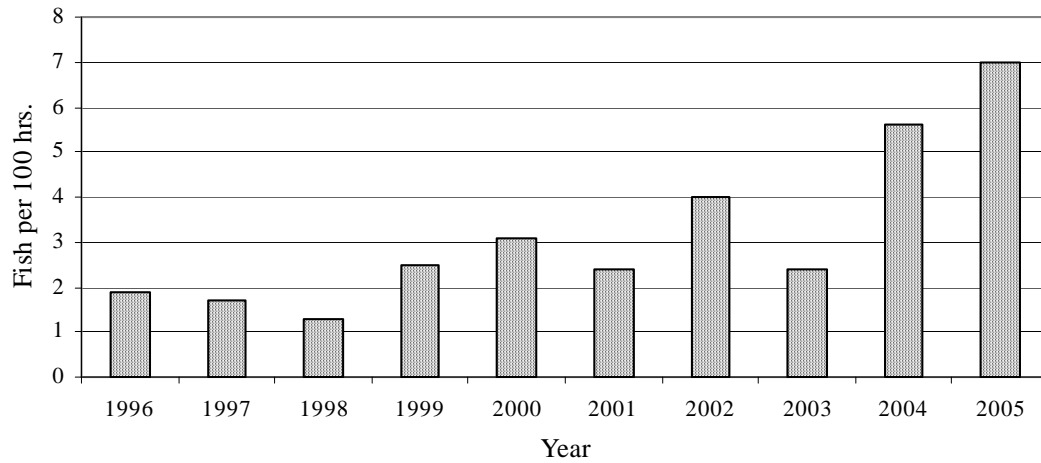


Figure 3. Harvest rate for Chinook salmon from the IDNR Lake Michigan creel survey during 1996 through 2005, based on directed effort.

Mean harvest rate = 3.7 fish/100 hours
Range: 2.1 - 5.9

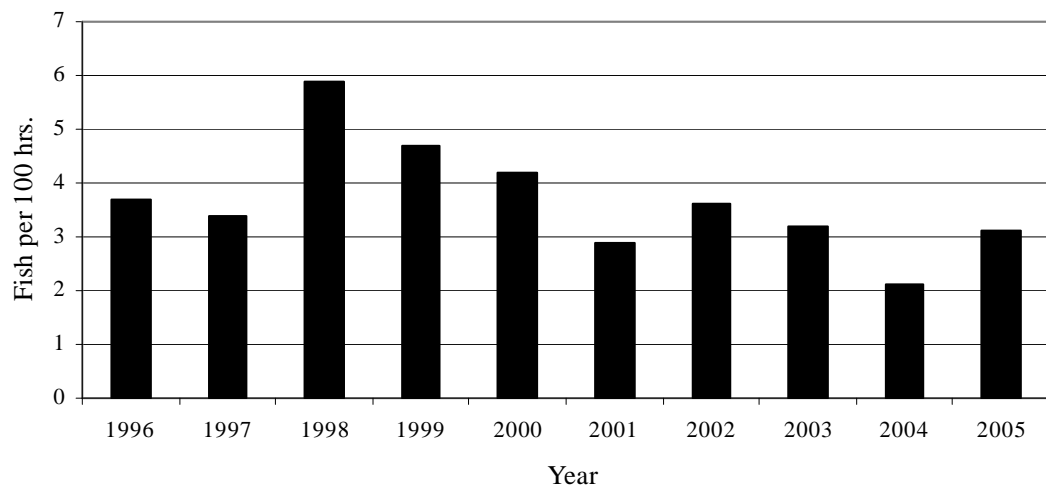


Figure 4. Harvest rate for steelhead from the IDNR Lake Michigan creel survey during 1996 through 2005, based on directed effort.

Mean harvest rate = 0.5 fish/100 hrs.
Range: 0.2 - 0.9

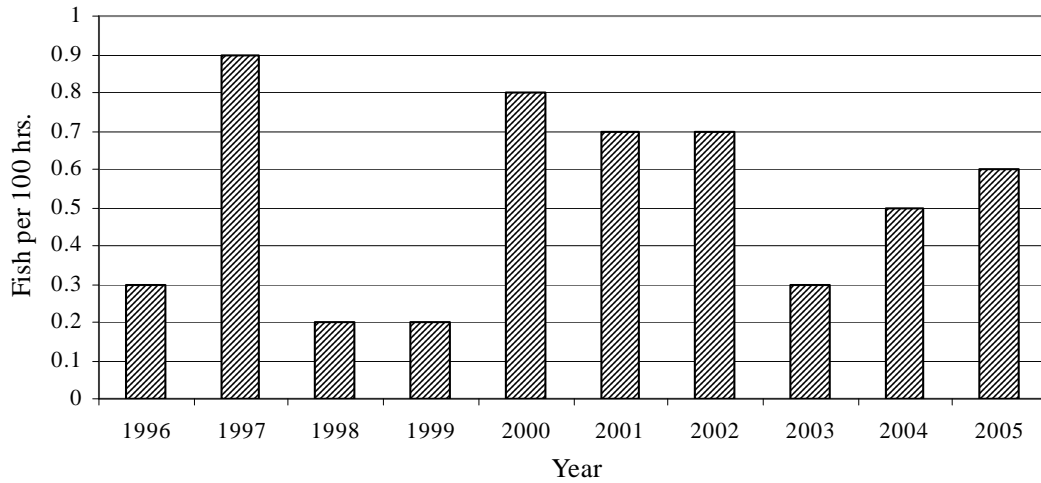


Figure 5. Harvest rate for brown trout from the IDNR Lake Michigan creel survey during 1996 through 2005, based on directed effort.

Mean harvest rate = 1.7 fish/100 hrs.
Range: 0.1 - 6.0

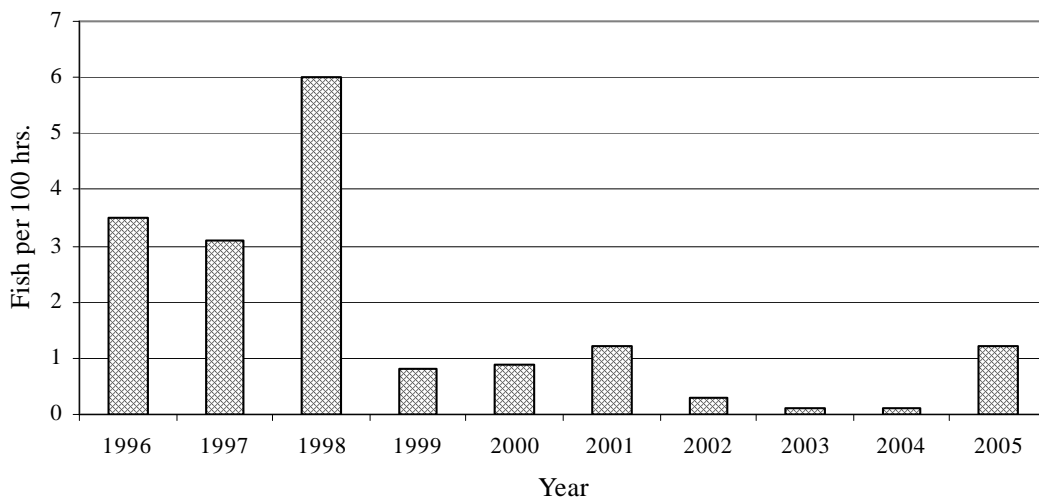


Figure 6. Harvest rate for lake trout from the IDNR Lake Michigan creel survey during 1996 through 2005, based on directed effort.

Mean harvest rate = 1.3 fish/hr.
Range: 0.9 - 1.8

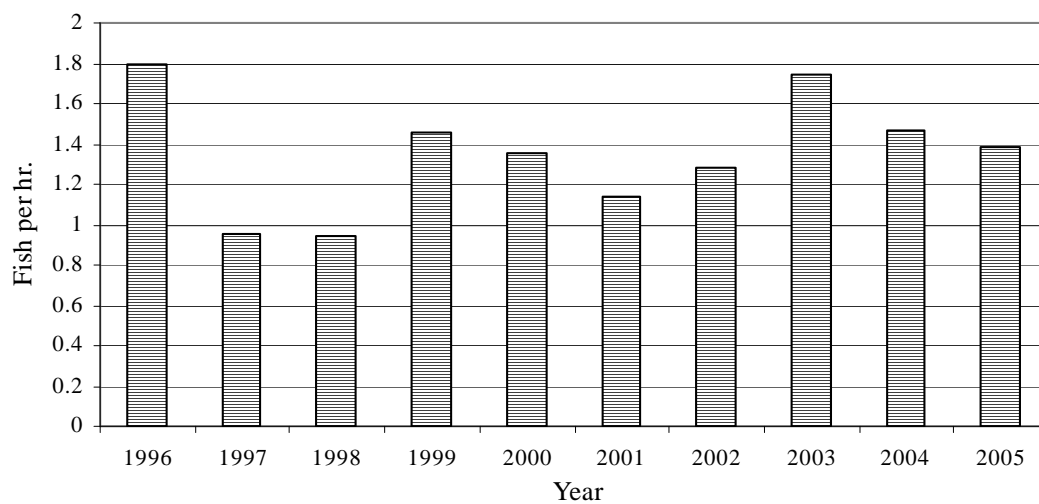


Figure 7. Harvest rate for yellow perch from the IDNR Lake Michigan creel survey during 1996 through 2005, based on directed effort.